

southeast and apparently lost its force before reaching the eastern line of the county. This storm was undoubtedly a true tornado. A funnel-shaped cloud was reported, which seemed to lift and dip, reaching the earth from time to time, and considerable damage was done to buildings and trees. From the report made by Prof. H. V. Egbert, of Buchtel College, Akron, Ohio, it is evident that the Summit county storm was a continuation of the one reported in Medina county. The tornado seems to have formed near the border line of Montville and Sharon townships, and to have pursued a southeast course across Sharon township for a distance of about five miles, ending about twelve miles west of Akron. It was next felt at a point about four miles southeast of Akron at 7.30 p. m., and from this point it pursued a course of about five miles in a southeasterly direction. The weather was very sultry before the storm and moderately cool afterward. A storm swept over Highland Park, Ill., destroying property to an estimated value of \$40,000, and severe storms, attended by heavy hail, were reported at Roberts and Prophetstown, Ill. On the night of the 9th a severe storm swept along the Rappahannock Valley, Virginia, demolishing trees, etc., and very heavy rain fell. Western Pennsylvania was visited by unusually heavy rain, wind, and electrical storms; severe wind and thunder-storms prevailed in the Lake region; and heavy storms were reported in South Carolina, Georgia, and eastern

Alabama. On the 13th a severe rain and hail storm passed over the northern part of Champaign county, Illinois; the hail-stones were of unusual size, and a large number of cattle were killed. On the night of the 23d-24th an unusually severe thunder-storm passed over Abilene, Tex. Numerous bridges were carried away by swollen streams, much stock was drowned, crops sustained serious damage, and many settlers in Lythe Creek bottom were rescued with difficulty. A heavy thunder-storm, accompanied by hail, occurred the night of the 24th; the hail-stones were compact pieces of ice, oval in form, solid in structure, and about the size of a chestnut. From the 24th to 26th great damage by heavy rains was reported in Texas; large tracts of country in the north-central and central sections of the state were under water, and the inundation extended into Indian Territory. Railroads suffered from washouts and the loss of bridges. On the evening of the 26th a heavy rain and hail-storm passed over the southeastern part of Memphis Tenn., covering the ground with hail-stones as large as hickory nuts. On the 27th, between 3.45 and 4.00 p. m., a heavy hail storm passed southeastward over Baltimore, Md. The hail-stones were very large, many measuring more than two inches in diameter and weighing over four ounces. Thousands of window panes, mostly with western exposure, were broken by the hail. Very heavy rain fell with the hail, 0.80 inch having fallen in fifteen minutes.

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the several stations; the highest and lowest water during April, 1890, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, April, 1890 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.	29.9	30	30.6	1	26.2	4.4
<i>Arkansas River:</i>						
Fort Smith, Ark.	22.0	28	21.0	1	4.4	16.6
Little Rock, Ark.	23.0	29, 30	24.3	15	10.8	13.5
<i>Missouri River:</i>						
Ft. Buford, N. Dak.		6	4.4	16, 21, 22, 23	0.9	3.5
Sioux City, Iowa.		14	9.5	19	6.5	3.0
Omaha, Neb.	18.0	15	10.0	1, 2	6.4	3.6
Kansas City, Mo.	21.0	14	9.6	1, 30	6.7	2.9
<i>Mississippi River:</i>						
Saint Paul, Minn.	14.5	13	5.5	2, 3	1.5	4.0
La Crosse, Wis.	24.0	18, 19, 20	9.1	2, 3	3.1	6.0
Dubuque, Iowa.	16.0	23, 24	12.1	1, 3	3.6	8.5
Davenport, Iowa.	15.0	26, 27	8.7	2, 3	2.8	5.9
Keokuk, Iowa.	14.0	27, 10, 30	8.4	5	3.2	5.2
Saint Louis, Mo.	32.0	27	18.7	13, 14	12.0	6.7
Cairo, Ill.	40.0	3, 4, 5, 6	48.7	22	33.3	15.4
Memphis, Tenn.	33.0	3, 4, 5, 6	35.6	28	28.0	7.6
Vicksburg, Miss.	41.0	25	49.1	1	46.3	2.8
New Orleans, La.	13.0	3	16.3	30	14.7	1.6
<i>Ohio River:</i>						
Pittsburgh, Pa.	22.0	10	18.8	24, 25	3.6	15.2
Parkersburg, W. Va.	38.0	12	26.6	27	6.8	19.8
Cincinnati, Ohio.	50.0	1	42.0	26	18.9	23.3
Louisville, Ky.	25.0	1	27.6	26	9.0	18.6
<i>Cumberland River:</i>						
Nashville, Tenn.	40.0	1	26.8	16	10.6	16.2
<i>Tennessee River:</i>						
Chattanooga, Tenn.	33.0	20	20.4	16	6.9	13.5
<i>Monongahela River:</i>						
Pittsburgh, Pa.	29.0	10	18.8	24, 25	3.6	15.2
<i>Savannah River:</i>						
Augusta, Ga.	32.0	6	12.2	30	7.4	4.8
<i>Willamette River:</i>						
Portland, Oregon.	15.0	30	10.1	1	5.0	5.1

*On April 1st the zero of the gauge at Memphis, Tenn., was lowered one foot, and all stages of water reported for previous dates should have one foot deducted, for purposes of comparison.

FLOODS.

The extreme flood conditions which prevailed in the lower Mississippi valley during March continued through April. At the beginning of the month twenty-one crevasses or breaks had occurred in the levees of the Mississippi River in Arkansas, Mississippi, and Louisiana. The breaks at Offutt and

Skipwith, Miss., had flooded southern Washington, Issaquena, and western Sharkey counties, Miss.; all of the streets in the upper part of Greenville, Miss., were under water; Huntington, Miss., was inundated, and the land back of Rolling Fork, Miss., and all of the country back of Mayersville, Miss., was flooded. The water flowing from the Nita crevasse had covered the greater portion of Saint James, Saint John, Saint Charles, and Jefferson parishes, Louisiana, as early as the 4th of the month, and on the 13th it reached the Illinois Central Railroad, and within twenty-four hours had covered the tracks for twenty miles. A great amount of water from the Nita crevasse passed into Lake Pontchartrain by means of the Manchac Passes, raising the level of the lake materially, and a high southeast wind on the 22d had the effect of flooding the rear part of New Orleans by driving the water from the lake.

The following is a list of crevasses reported during the month, with the stage and the rise or fall of the river at the more important points:

On the 1st there had been a sharp fall in all the tributaries of the Mississippi, except the Arkansas River, and the Mississippi River was falling from Memphis, Tenn., to Vicksburg, Miss. The stage of the water at Cairo, Ill., was 48.5 feet and rising; at Memphis, Tenn., 35.3 feet and rising; at Arkansas City, Ark., 48.5 feet and stationary; at Helena, Ark., 47.5 feet; at Natchez, Miss., 45.6 feet; at Vicksburg, Miss., 46.3 feet and stationary; at Red River Landing, La., 45.1 feet; at New Orleans, La., 15.9 feet and stationary; and at Baton Rouge, La., 34.9 feet. On the 2d a small break occurred at Bohemia, La., fifty miles below New Orleans; the stage of the river at Cairo, Ill., was 48.6 feet, and the Ohio River at that point had risen 2 feet in eight days. The Tennessee, Cumberland, and upper Mississippi rivers were falling rapidly; the lower Mississippi river was rising at Memphis, Tenn., Vicksburg, Miss., and New Orleans, La., and falling at Helena and Arkansas City, Ark. By the 3d the river had risen slowly at Memphis, Tenn., and had again reached the high-water mark, 35.6 feet; a second break had occurred in the levee at Bohemia. On this date the lower Mississippi river was rising, except at Helena, Ark., and New Orleans, La., where it was stationary. On the 4th the Levee at Catfish Point, Miss., fifty-five miles above Greenville, Miss., broke, the crevasse rapidly widening to 1,500 feet. Three lives were reported lost by the breaking

of this levee, many houses were washed away, several thousand acres of cultivated land were submerged, much stock was drowned, and the town of Bolivar, Miss., was under water. On this date the river was rising at Memphis, Tenn., Vicksburg, Miss., and New Orleans, La.; it was falling at Helena and Arkansas City, Ark.; and was stationary at Cairo, Ill. On the 5th the levee was cut at Boggy Bayou, fifteen miles above Arkansas City, Ark.; by the end of the month this break had widened to 273 feet. Nine breaks occurred between Catfish Point and Easton Landing, Miss., on the 4th and 5th, on account of the volume of water passing in through the break at Catfish Point and passing out over the levee into the river again at the next bend of the river. On this date the stage of the water at Cairo, Ill., was 48.7 feet and stationary; at Memphis, Tenn., 35.6 feet and rising; at Arkansas City, Ark., 47.9 feet and falling; at Helena, Ark., 47.3 feet and falling; at Vicksburg, Miss., 46.8 feet and rising; at Natchez, Miss., 45.8 feet; at Red River Landing, La., 45.6 feet; at New Orleans, La., 16.1 feet and falling; and at Baton Rouge, La., 35.2 feet. On the 6th the river at Memphis, Tenn., which had remained at 35.6 feet since the 3d, began to fall slowly; the river was rising at Vicksburg, Miss., and was stationary at Cairo, Ill., and New Orleans, La. On the 7th the Opossum Fork levee, seventy-seven miles above Vicksburg, was cut and great damage was done to adjacent property. On this date the river was rising at Vicksburg, Miss., nearly stationary at Memphis, Tenn., and falling at Cairo, Ill., Helena, Ark., and New Orleans, La.

On the 8th a crevasse 215 feet wide occurred at Simmesport, Avoyelles parish, La., on the Atchafalaya River. On the 10th two breaks occurred at Bedford, La., but a new levee was immediately thrown up behind the old one; a small break occurred sixty miles below New Orleans, but was promptly closed; the crevasse at Live Oak Plantation, La., was closed; and at Bohemia, La., a new break 35 feet wide occurred, and the entire levee at that place was reported in a bad condition. On this date the river was rising steadily below Vicksburg and had been rising for about a week at the rate of about two inches a day as a result of the flood from the Ohio River. On the 11th another small break was reported at Bohemia, La. On the 14th 100 feet of levee gave way at Plaquemine, La. On this date the river was falling at Cairo, Ill., and Memphis, Tenn.; was stationary at Helena, Ark., and Vicksburg, Miss., and was rising at New Orleans. On the 17th the river at Memphis, Tenn., which had been falling slowly since the 6th, began to fall more rapidly. On the 18th two small breaks occurred on the west bank of the Atchafalaya, but they were promptly closed. A break was also reported at Saint Gabriel, La. On this date the river was falling at Cairo, Ill., Memphis, Tenn., and Helena, Ark.; was rising at Vicksburg, Miss., and stationary at New Orleans, La. On the 19th a crevasse 60 feet wide occurred at Riceland Plantation, La., and three small breaks, the largest being 70 feet wide, occurred at Wilkinson's Plantation, on the east side of the river, thirty-five miles below New Orleans. On this date the river continued to fall at Cairo, Ill., Memphis, Tenn., and Helena, Ark.; was rising at Vicksburg, Miss., and stationary at New Orleans, La. On the 21st the levee broke at midnight at Bayou Sara, thirty miles above Baton Rouge, La.; a crevasse 50 feet wide occurred at Martinez Place, ten miles below Baton Rouge, La.; there were several breaks, the largest being 200 feet wide, in Plaquemine parish, near Saint Sophie; the upper end of the old Morganza levee gave way; in the Pointe Coupee levees a crevasse 840 feet wide occurred at Fanny Riche, and one 50 feet wide at Preston. On this date the river was stationary at Vicksburg, Miss., and falling above that point; it was 16.0 feet on the gauge at New Orleans, La., but fell 1.0 foot at that place by the 25th. On the 22d the highest water of the month, 31.9 feet, occurred at Plaquemine, La.; a crevasse occurred at Lake Concordia, Concordia parish, La.; a break 650 feet wide occurred in the levee at Morganza, Point Coupee parish, La.; a break 100 feet wide occurred at Martinez, ten miles below Baton Rouge, La.; sev-

eral breaks were reported at Saint Sophie, Plaquemine parish, La.; a break 150 feet wide occurred at Vidalia, La.; and breaks were reported at Lobdell's Landing, sixteen miles above Baton Rouge, La., and at Raccourci, Point Coupee parish, La. On this date the river was rising at Vicksburg, Miss., where it measured 48.8 feet on the gauge, and was falling above that point and at New Orleans, La.

On the 23d the crevasse at Saint Sophie was closed; the Red River fell below the danger-line at Shreveport, La.; the highest water of the month, 48.55 feet, occurred at Natchez, Miss.; on the Atchafalaya River a break 150 feet wide occurred at Ferguson, and one 110 feet wide at Barbin's; on the Pointe Coupee front a crevasse 110 feet wide occurred at Lanaux, and one 90 feet wide at Sneed. On this date the river was 33.4 feet and rising at Cairo, Ill.; 48.9 feet and rising at Vicksburg, Miss.; and was falling at Memphis, Tenn.; Helena, Ark., and New Orleans, La. On the 24th a break 700 feet wide occurred at Fanny Joer Place, Pointe Coupee front, and the highest water of the month, 45.1 feet, was reported at Saint Joseph, La. The river continued to rise at Cairo, Ill., and Vicksburg, Miss., and was falling at Memphis, Tenn., Helena, Ark., and New Orleans, La. On the 25th a break 1,200 feet wide occurred in the lower Morganza levee. On this date the river was 33.5 feet and stationary at Cairo, Ill.; 28.7 feet and stationary at Memphis, Tenn.; 47.1 feet at Arkansas City, Ark.; 49.1 feet and rising at Vicksburg, Miss., and 15.0 feet and falling at New Orleans, La. On the 26th the river was falling at Vicksburg, Miss., and along the upper Louisiana front. On the 28th the Martinez crevasse was closed; the Red River again reached the danger-line at Shreveport, La., and continued to rise at that place until the close of the month, when it stood at 30.6 feet, the highest water reached this year; a slight rise set in at Memphis, Tenn., and the river continued to rise at that point until the close of the month; the river was rising at Cairo, Ill., and falling at Vicksburg, Miss., and New Orleans, La. On the 30th a break 300 feet wide occurred at Point Manoir, West Baton Rouge parish, La. At the close of the month the river was 36.2 feet and rising at Cairo, Ill., and 3.8 feet below the danger-line; at Memphis, Tenn., 28.6 feet and rising, and 4.4 feet below the danger-line; at Helena, Ark., 41.3 feet and falling, and 4.3 feet below the danger-line; at Vicksburg, Miss., 48.7 feet and falling, and 7.7 feet above the danger-line; at New Orleans, La., 14.7 feet and falling, and 1.7 foot above the danger-line; at Shreveport, La., the Red River was 30.6 feet and rising, and 0.7 foot above the danger-line; at Fort Smith, Ark., the Arkansas River was 18.5 feet and falling, and 2.5 feet above the danger-line; and at Little Rock, Ark., the Arkansas River was 24.3 feet and falling, and 1.3 foot above the danger-line. From April 1st to 30th there was a fall of 12.3 feet in the river at Cairo, Ill.; a fall of 6.7 feet at Memphis, Tenn.; a fall of 6.2 feet at Helena, Ark.; a fall of 2.7 feet at Arkansas City, Ark.; a rise of 2.4 feet at Vicksburg, Miss.; a rise of 2.2 feet at Natchez, Miss.; a rise of 2.5 feet at Red River Landing, La.; a fall of 1.2 foot at New Orleans, La.; and a fall of 0.1 foot at Baton Rouge, La.

The present flood proceeded mainly from the Ohio River and its tributaries, aided by a very high stage of water in the White and Arkansas rivers. There were six rises in the upper Ohio river met by freshets from the Cumberland and Tennessee rivers, resulting in four distinct rises at Cairo, Ill. The amount of territory overflowed and the damage to property and stock cannot be estimated at the present time. The country generally between the Mississippi and Ouachita rivers was under water, all lowlands being submerged. The water from the crevasses in southern Louisiana caused an incalculable amount of damage, and it was not thought that the water would recede in time to permit of the cultivation of a greater part of the inundated land. The flood in Louisiana was only exceeded in recent years by the floods of 1874 and 1882. Not less than fifteen parishes, or one-fourth of the state, was affected. In 1882 the loss was placed at \$15,000,000. It will probably be about one-half of that amount this year. In 1882 the breaks

occurred with a rising river, while in the flood of the present year the Mississippi had begun to fall from Cairo to Vicksburg before the most disastrous crevasses occurred. The Pointe Coupee levees protected the sugar belt and were the most important in the state of Louisiana, or in the entire Mississippi system. The principal of these was the great Morganza levee, which was the first to go along the Pointe Coupee front; it was closely followed by numerous other breaks, and practically the entire parish was flooded, save sections protected by interior levees. The vast volume of water which escaped through the Pointe Coupee breaks caused a marked fall in the river below. The flooded area in Louisiana was probably not less than 5,000 square miles. The Austin crevasse overflowed about 10,000 acres of cleared land in Mississippi, and on the Arkansas side of the river about 10,000 acres were inundated.

The Ohio River fell below the danger line at Louisville, Ky., during the 1st, and by the 23d it was again confined to its banks at Paducah, Ky. On the 9th a large part of Johnstown, Pa., was flooded. The excessive rainfall of the latter part of the month caused disastrous floods in north-central Texas, more especially along the Trinity River.

OPENING OF NAVIGATION.

Lake Superior.—Boats arrived and departed from Duluth, Minn., and Marquette, Mich., during the latter part of the month, and Mackinaw Straits, which were closed by ice on the 1st, were open to navigation on the 11th.

Green Bay.—On the 11th the bay was free of ice as far as could be seen from Green Bay, Wis., and on the night of this date the lights at Grassy Island and Long Tail Point were lighted for the first time this season.

Sault de Ste. Marie River.—A steam barge arrived at Sault de Ste. Marie, Mich., 20th; this was the first arrival of the season.

Mississippi River.—The first through boat of the season from the south arrived at Saint Paul, Minn., 24th. The first boat of the season passed up the river at Dubuque, Iowa, on the 1st.

Missouri River.—At Fort Buford, N. Dak., the ice began to break up on the 5th, and by the 8th the river was clear of ice. At Fort Yates, N. Dak., the ice broke up on the morning of the 4th, and the river was clear of ice on the 10th. At Fort Sully, S. Dak., the river was clear of ice on the 6th, but the water was so low as to seriously interfere with navigation.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroras were observed during the month as follows: 7th, South Canisteo, N. Y. 8th, Fort Custer, Mont., and Greenville, Pa. 11th, South Canisteo, N. Y. 14th, Clinton, Iowa; Glasgow, Wis., and Rolling Green, Minn. 15th, Saint Vincent, Minn. 16th, Boston, Mass., and Eastport, Me. 17th, Fort Custer, Mont., and Glasgow, Wis. 22d, Lyons, N. Y. 24th, Berrien Springs, Mich. 26th, Middleburgh, N. Y. 27th, Oskaloosa, Iowa.

Fort Custer, Mont., 8th: a faint auroral light was observed at 10.45 p. m., and lasted until 11.10 p. m. It was in the form of a diffused light located 20° west of north. Another aurora was observed between 10.15 p. m. and 11.15 p. m., 17th. It consisted of an irregular pale arch of light in the northern sky, and rose to about altitude 45°.

Saint Vincent, Minn.: an auroral display, consisting of a pale diffused light, was observed from 9.40 p. m. to 11.45 p. m., 15th; it extended from azimuth 195° to 240° and to altitude 10°.

THUNDER-STORMS.

The more severe thunder-storms of the month are described under "Local storms." East of the Rocky Mountains thunder-storms were reported in the greatest number of states and territories, twenty-four, on the 9th; in eighteen on the 27th; in seventeen on the 8th, 14th, 26th, and 30th; in from eleven

to sixteen, inclusive, on the 2d, 3d, 4th, 7th, 13th, 22d to 25th, 28th, and 29th; in from five to ten, inclusive, on the 1st, 6th, 10th, 12th, and 15th to 21st; and in two on the 5th and 11th. There were no dates on which thunder-storms did not occur east of the Rocky Mountains.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, twenty-four, in Texas; on nineteen in Michigan; on sixteen in Kansas; on from eleven to fifteen, inclusive, in Arkansas, Florida, Illinois, Iowa, Louisiana, Minnesota, Mississippi, Missouri, New York, North Carolina, Ohio, and Tennessee; and on from one to ten, inclusive, in Alabama, Connecticut, North Dakota, District of Columbia, Georgia, Indiana, Indian Territory, Kentucky, Maryland, Massachusetts, Montana, Nebraska, New Hampshire, New Jersey, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Vermont, Virginia, West Virginia, and Wisconsin. Delaware and Maine were the only states in which thunder-storms were not reported during the month. West of the Rocky Mountains thunder-storms were reported as follows: Arizona, 1st, 10th, 11th, 15th, 22d, and 23d; California, 18th and 23d; Colorado, 1st, 19th to 24th, 26th and 30th; Idaho, 30th; Nevada, 26th, 29th, and 30th; New Mexico, 15th, 16th, 18th to 21st, 24th, 27th, and 29th; Utah, 22d, 23d, and 24th; Washington, 11th and 25th; Wyoming, 19th, 21st, 22d, and 30th. There were no states or territories west of the Rocky Mountains in which thunder-storms were not reported.

MISCELLANEOUS PHENOMENA.

DROUGHT.

Rain on the 28th broke the drought which had prevailed in the vicinity of Savannah, Ga., during the last three months. The long drought in the Rio Grande Valley was broken by heavy rain on the 17th. The prevailing drought in the vicinity of Key West, Fla., was beginning to be severely felt at the close of the month. Reports from Huron, S. Dak., state that the continued drought was damaging sprouting grain, and that rain was badly needed in that section.

HALOS.

Solar and lunar halos were reported in New England and the middle Atlantic states on twenty-four dates; 75 per cent. of the halos were attended on the first day, 71 per cent. were followed on the second day, and 67 per cent. were followed on

the third day by rain or snow. In the south Atlantic states halos were reported on thirteen dates; 62 per cent. of the halos were attended on the first day, 70 per cent. were followed on the second day, and 46 per cent. were followed on the third day by rain. In the Gulf States halos were reported on thirteen dates; 62 per cent. of the halos were attended on the first day, 54 per cent. were followed on the second day, and 46 per cent. were followed on the third day by rain. In the Mississippi and Ohio valleys halos were reported on twenty-three dates; 74 per cent. of the halos were attended on the first day, 74 per cent. were followed on the second day, and 65 per cent. were followed on the third day by rain or snow. In the Lake region halos were reported on twenty-one dates; 67 per cent. of the halos were attended on the first day, 62 per cent. were followed on the second day, and 67 per cent. were followed on